AMC

# SAFETY DIGEST

AMCP 385-99



FEDERAL
SAFETY

ZERO in



JANUARY 1971

THE WHITE HOUSE

WASHINGTON

October 23, 1970

MEMORANDUM FOR

HEADS OF DEPARTMENTS AND AGENCIES

It is most important that the men and women who serve our Nation in the Federal service be fully safeguarded from injury in the performance of their tasks. They must suffer no avoidable risk.

At the end of this year, we shall complete Mission SAFETY-70 which has averted over 22 thousand disabling injuries since 1964. Nonetheless the 43,000 such injuries sustained last year are of deep continuing concern. They show the need for renewed effort.

Mission SAFETY-70 provided a broad, overall approach to Federal work safety. Now we need a specific approach. Accordingly, I am today announcing a new safety program for all Federal personnel.

"ZERO IN on Federal Safety" will start January 1st and continue for two years.

Under this program, each Federal agency must find ways to locate the specific work hazards which injure its employees--and remove them. For example, handling materials causes over one-quarter of our job injuries, slips and falls over one-fifth.

Whether the agency's chief problems stem from these or other causes, it is evident that job injuries can be prevented only where they occur--by the agency at the place of work. Tested techniques exist to prevent them.

At my request, Secretary of Labor Hodgson has today written all agency heads detailing the new program.

I have proposed many programs to improve the quality of life in America. That quality in the workplaces of the Federal service must be the best--both for the protection of our employees and as an example to the Nation.

Richard Nixon

# HEADQUARTERS
# UNITED STATES ARMY MATERIEL COMMAND
## WASHINGTON, D.C. 20315

AMC PAMPHLET Number 385-99 JANUARY 1971

The Safety Digest is an AMC Pamphlet prepared by the Safety Office, Headquarters, U. S. Army Materiel Command. Its purpose is to disseminate information which can materially influence and improve safety programs at all Command establishments.

Articles are included to supplement technical knowledge as well as practical knowledge gained through experience. They provide a basis for the further refinement of safety measures already incorporated in operating procedures and process layout. To achieve maximum effectiveness, the Safety Digest should be given widespread circulation at each AMC establishment.

Articles appearing in the Safety Digest are unclassified and are not copyrighted. They may be reproduced as desired in order to bring pertinent accident prevention information to the attention of all employees. The Army Materiel Command Safety Digest should be given a credit line when articles are extracted.

Unclassified material believed to be of interest or benefit to other establishments is welcome for publication in the Safety Digest. Please send articles for review to: U. S. Army Materiel Command Field Safety Agency, Charlestown, Indiana. If possible, include pictures, charts, drawings, and illustrations that clarify and heighten interest in your presentation.

(AMCSF)

FOR THE COMMANDER:

CHARLES T. HORNER, JR.
Major General, USA
Chief of Staff

OFFICIAL:

P. R. HORNE
Colonel, GS
Chief, HQ Admin Mgt Ofc

Special Distribution 1

# IN THIS ISSUE

# AMC WINS DA AWARD OF MERIT FOR FY 1970

Chief of Staff, United States Army,advised the CG, USAMC, that AMC has won the DA Award of Merit for FY 1970.

A significant safety achievement by AMC personnel was the reduction of fatalities from 36 during FY 1969 to 19 during FY 1970. This was the best record since FY 1963. Other improvements were reductions of explosions from 118 to 26; property damage losses due to explosions from $7.1 million to $746,000; cost of fires from $2.1 million to $1.1 million; and, as the result of the above improvements, monetary costs of AMC property damage, fatalities and injuries were reduced from $13.9 (FY 1969) to $5.5 million (FY 1970).

23 November 1970

Dear Hank:

Congratulations to you and your command on winning the Department of the Army Safety Award of Merit for FY 1970.

A plaque, symbolic of the award, is being engraved for presentation at the earliest appropriate occasion.

Sincerely,

W. C. WESTMORELAND
General, United States Army
Chief of Staff

General Henry A. Miley, Jr.
Commanding General
United States Army Materiel Command
Washington, D. C. 20315

## SYSTEM SAFETY PROGRAM REQUIREMENTS, PLANNING AND MANAGEMENT

Since the basic concepts and objectives of system safety have been previously described ("An Introduction to System Safety;" AMC Safety Digest, November 1970), this article will present an overview of the life cycle of Army materiel and indicate some of the more important safety inputs.

By way of review, it should be recalled that the Army life cycle consists of four parts, or phases, commonly referred to as:

1. Concept formulation.

2. Contract definition.

3. Development and production.

4. Operations and disposal.

Further, it must also be noted that the major AMC life cycle document, AMCR 11-27 (an adaption of the Army life cycle document, DA Pam 11-25, tailored to meet AMC objectives), does not contain a formal safety input. Some guidelines in the area of safety are given, however, relative to life cycle phases, in both MIL-STD-882 and AMCP 385-23.

Throughout the discussion that follows, it is assumed that the system development program includes each of the four phases outlined above. Also, since each system is unique; i.e., the phases are not followed as distinctly as stated in all cases, each system safety program must be modified to fit specific system needs. The milestones, or activities, included in the safety life cycle, however, must be accomplished at some time during the life cycle to insure a balanced, efficient and effective design. For example, should the program not include provisions for a formal contract definition phase, the necessary contract definition safety activities must be accomplished very early in the development phase.

The life cycle has its beginning with the concept studies subphase. During this period longrange forecasting studies are undertaken for use in the land combat systems study. Although some safety effort is required during this subphase, the major activity begins somewhat later in this phase.

The second part of concept formulation, the research planning subphase, includes those activities designed to accomplish major research planning. Work is expended at this time

toward formalization of a Qualitative Materiel Development Objective (QMDO). The QMDO is, by definition, a DA approved statement of a future need for developing new effective materiel, the technical feasibility or specific definition of which cannot be determined sufficiently to permit the establishment of a QMR (Qualitative Materiel Requirement). These documents are normally derived from Combat Development Command (CDC) doctrinal studies, performed during the concept studies subphase, and submitted to DA for approval. They provide guidance to the developing agencies; e.g., AMC, in preparing the QMDO plan. The major safety input begins upon initiation of the QMDO with provision of a technical safety input to the QMDO plan.

During the system definition subphase, several prerequisites for contract definition must be accomplished. These are discussed in some detail in AMCR 70-30 (Concept Formulation--Prerequisites to Initiating Engineering or Operational Systems Development Effort). Briefly, the six prerequisites are:

1. Primarily, engineering rather than experimental effort is required and the technology needed is sufficiently in hand.

2. The mission and performance envelopes are defined.

3. The best technical approaches have been selected.

4. A thorough trade-off analysis has been made.

5. The cost effectiveness of the proposed item has been determined to be favorable in relationship to the cost effectiveness of competing items on a Department of Defense (DOD)-wide basis.

6. Cost and schedule estimates are credible and acceptable.

The objectives of these prerequisites are to insure that all reasonable system alternatives have been evaluated, that the proposed system has been "optimized" and that the project is likely to be successful if development is started.

The safety activities which take place during this subphase consist of making inputs to milestones which satisfy the above-mentioned prerequisites. Of particular note are initiation of a preliminary hazard analysis, both intra- and some inter-system trade-off studies, and review of the QMR (a DA approved statement of a military need for a new item, system or assemblage, the economic, technical, and operational feasibility of which has been determined).

Within the QMR the various system parameters such as reliability, maintainability and safety are included and, in effect, ranked in order of importance so that the developer will be able to judge the amount of effort to be spent on each.

During the final portion of concept formulation, the decision subphase, the project is reviewed and approval is sought to enter the contract definition phase.

The activities within this subphase consist of a review of the system development plan (SDP) by AMC, CDC and the Continental Army Command (CONARC).

The SDP, prepared in accordance with AR 70-27 (Advanced Development Plans/ System Development Plans), is a summary of all applicable plans (including a System Safety Plan) for the development and deployment of a weapon system or major equipment. It outlines projected goals and methods of attaining the QMR.

The actual review takes place in the form of informal and formal in-process reviews (IPRs) which must be attended by safety personnel and culminates with a system status evaluation (SSE) during which time a tentative decision to proceed with full-scale development will hopefully be received from the Office of the Secretary of Defense (OSD).

After the decision has been made to proceed into contract definition, or more precisely, engineering development, work during this phase is directed toward achieving a high level of confidence that the project's cost, schedule and performance goals can be reached, and the development of performance specifications for inclusion in the development contract. The overall objective of this phase is to determine whether the conditional decision to proceed with engineering development should be ratified.

During Phase A of contract definition,competing contractors are selected for Phase B.

In order to transmit information to potential contractors, it is necessary that he be provided with firm guidelines, which will communicate fully DA's intent and, based on the approved QMR, specify requirements in detail. This is accomplished typically in a request for proposal (RFP). An outline of the information to be included in this document is given in AR 705-5 (Army Research and Development) and AMCP 385-23.

Some typical procuring activity safety responsibilities include incorporation of safety requirements into RFPs and statements of work, identification of safety data to be provided to the definition contractor (results from preliminary hazard analyses and trade-off studies) and identification of safety data to be required from the contractor (system safety program plan, PHA and other analyses).

Some typical contractor safety actions might include preparation and submission of a preliminary system safety program plan (SSPP) which is the cornerstone of the entire system safety program, development of required safety analyses and participation in trade-off studies.

Phase B begins with the award of Phase A contract definition contracts, includes preparation of the selected contractors' proposals for engineering development and ends with the contractors' submittals of contract definition reports and development proposals. Safety activities during this subphase essentially involve efforts to be accomplished by the definition contractor(s).

Phase C of contract definition begins immediately after the submission of the contract definition reports and describes their evaluation. It also includes selection of the preferred contractors for conducting engineering or operational systems development and proceeds to the signing of a definitive development contract.

In this phase the procuring activity evaluates the proposals submitted in response to the definition contract, preparatory to the selection of a contractor for the development and production phase. Typically the procuring activity would review the potential contractors' safety effort.

The next major phase, development and production, actually consists of two overlapping efforts -- development and production. Note that both subphases are contracted for separately.

Some of the safety activities that must be accomplished primarily by the selected contractor include:

1. Completion of analyses.

2. Participation in design reviews.

3. Updating the SSPP.

4. Review and evaluation of test plans and results.

5. Training of operating and user personnel.

In the final phase of the life cycle, operations and disposal, the safety professional is concerned with how well the system performs on a day-to-day basis under actual environmental conditions.

Typical safety activities include:

1. Monitoring of tests; e.g., troop tests.

2. Evaluation of system effectiveness. This is usually thought of in forms of availability (how often), dependability (how long) and capability (how well).

3. Safety review of engineering change proposals (ECPs), equipment improvement recommendations (EIRs) and modification work orders (MWOs). Data obtained from these sources is valuable not only in eliminating a current problem but also in the prevention of similar problems on future systems.

4. Review and monitoring of disposal procedures.

In summary, we have seen that the life cycle is made up of four phases; i.e., concept formulation, contract defintion, development and production, and operations and disposal. It is also necessary to realize that safety plays an important role in each phase. Further, it is necessary to understand that the complexity of today's weapons' systems dictates that advance planning is a necessity, and that through this plan, safety can be applied using foresight rather than hindsight.

NOTE: The AMC Field Safety Agency is presenting four System Safety Courses during FY 1971. This training is mandatory for all AMC Safety Career Personnel.

## AMC SAFETY ENGINEERING GRADUATE TRAINING PROGRAM

The USAMC Field Safety Agency, Charlestown, Indiana, is presently providing training to the first class of the AMC Safety Engineering Graduate Training Program. Eighteen engineers are enrolled in this 2-year program which follows five classes of graduates under the Safety Career Management Intern Training Program.

The USAMC Intern Training Center located at Red River Army Depot, Texarkana, Texas, administered the first 16 months of the program in conjunction with Texas A&M University, College Station, Texas. The last eight month portion of the overall curriculum began at the Field Safety Agency in September 1970. The engineers pictured above are as follows:

First row L to R: James A. Cannon, Thomas W. DeLong, Robert D. Dempsey, James R. Dugger, John A. Dunn, Robert R. Duty

Second row L to R: Steve R. Fewell, David M. Gilchriest, Stephen E. Hall, Phillip T. Haltom, Michael F. Heard, Harold K. Oliver

Third row L to R: John T. Pfitzer, Leonard S. Pohl, Craig B. Schilder, Stephen K. Smurthwaite, Brent H. Weidman and Mark M. Zaugg.

# BEING PREPARED IS "BEING SAFE"

CW3 George J. Tomei, Safety Officer
US Army Aviation Test Board, Fort Rucker, Alabama

Everyone knows that the motto of the Boy Scouts is "Be Prepared;" but how many of us think of this motto in terms of Aviation Safety?

Think about it a minute. Are your aircraft prepared? Your pilots? How about your maintenance personnel and their tools? Prepared for flight--or prepared for disaster?

Your aircraft---? Instrument lights inoperative (day VFR only)? Pitot heater inoperative (VFR only)? Navigation radios inoperative (VFR only)? De-ice-anti-ice system inoperative (trace ice only)?

Grounding conditions? No, not even if all were on the same aircraft; but are the people you support aware that you can support them only between 0700 and 1700 when the sun is shining? In the Army we say we are on duty 24 hours a day; but can we say the same for our equipment?

Are your pilots prepared? Are they permitted to turn down a mission if they feel that it is beyond their capabilities as an aviator? Experience is the best teacher, but learning from your mistakes can't very well be used in aviation. If an inexperienced aviator in your unit turned down a mission because he felt he wasn't qualified, would the Operations Officer tell him, "How do you know you can't if you don't try it?" or would he complete the crew with an experienced aviator who could do the job and pass on knowledge and experience while completing the mission?

Do your pilots have the proper equipment prepared for flying: a flashlight, plotter, computer, Flip publication? How can anyone be sure that a flight will not have to be completed in instrument conditions or at night? On cross-country flights, why not even carry a RON kit to include razor, clean socks, money or credit cards. If an aviator has these items with him, he might RON rather than do something foolish. People can get a bad case of "Gethomeitis" when they are dirty and broke.

What about your maintenance personnel and their tools and equipment? You can't maintain an aircraft properly with untrained personnel and poorly maintained maintenance equipment. Do your crew chiefs know their assigned aircraft? Are they constantly training and being brought up-to-date on the latest techniques and equipment? Are they provided the proper equipment or is your tool room for inspections only?

(Cont'd. on pg 10)

# THE EXTRA ENGINE

CW3 Robert C. Jones
Installation Services Directorate, Edgewood Arsenal

The advantage of an "extra engine" on an aircraft is appreciated by most pilots and provides them a comforting sense of security, since most twin engine aircraft will sustain flight on one engine. Apparently, however, this sense of security sometimes becomes complacency, after all, "What are the odds against losing both engines?"

An experienced senior pilot departed his home station in a twin engined aircraft for a local proficiency training flight. The weather was excellent. He remained in the traffic pattern for about an hour then returned to the ramp for refueling. Before continuing on a two hour night proficiency flight a routine run-up and takeoff were made and the aircraft departed the pattern on an intended cross country flight at 3500 feet.

For 45 minutes the flight was routine with the pilot periodically explaining features of the aircraft to a co-pilot and passenger who had never flown this type of aircraft before. Darkness was steadily blocking out all ground features and lights were becoming more pronounced.

Suddenly the number one engine began surging. The pilot switched fuel tanks, checked carburetor heat and fuel pressure, and noted that this had no effect on the engine operation. The engine continued to surge with the aircraft yawing and gradually losing power. Although all instruments except the tachometer were indicating normal, a decision was made to shut down the engine and land at the nearest airport. A 180 degree turn was made and a brief description of the situation was radioed to the control tower of a large airport only 10 miles away.

Approximately three minutes after the number one engine was shut down, number two engine began to lose power, surging, backfiring and eventually failing. An attempt to restart number one engine, while selecting a forced landing site, was unsuccessful for lack of time. The pilot selected a field but the night emergency landing resulted in a collision with a tree during the landing roll.

A thorough after accident investigation included fuel contamination checks, engine test runs and bench tests of fuel pumps and carburetors. No mechanical cause for the failure of number one engine could be found and there was no evidence

or indication of carburetor icing. This same investigation determined that a possible cause of the number two engine failure was a malfunction of the outboard fuel system.

Despite the lack of a definitive cause for the failure of either engine, in the final analysis, this unfortunate accident may well have been caused by the premature feathering of the number one engine, which was secured in flight, contrary to the operating manual for this type aircraft, which states "Partial power is preferable to no power."

Shutting down one engine when the other engine is running smoothly is fairly routine and doesn't seem to matter much--that is unless you need it later on.

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(cont'd. from page 8)

Problems don't just "go away." Being prepared doesn't "just happen." It takes the attention and interest of everyone. We can allow ourselves to get in "so deep" that the only way out is to take a mission "no matter what." How deep is "deep" then--six feet?

If your aircraft, people and equipment are prepared, chances are your missions will be safe ones. If not--then be safe anyway--"CALL THE MOTOR POOL!"

## FORKLIFT ACCIDENTS NOT TAPERING OFF

Analysis of AMC accident experience has revealed that forklift accidents are continuing to occur at a rather alarming pace. One hundred forty-three (143) recordable accidents involving forklifts occurred at an average of five per month from July 1968 through September 1970. These accidents resulted in one fatality, 59 disabling injuries and property damage of several thousand dollars.

Identification of causal trends in regard to forklift accidents indicates that approximately 90% of the analyzed reports showed varying degrees of operator error as being attributive to the incidents. Disregard of approved operating procedures was the prevalent "unsafe act" noted in a review of the accidents.

In addition to cost effectiveness, forklifts and other types of materials handling equipment are utilized to reduce the accident potential associated with manual handling. It is ironical, however, that forklift operations result in so many disabling-injury accidents when their very use is designed for safer handling of material. The following narratives describe forklift accidents which occurred during the period under analysis. Could any of these incidents occur at your installation?

1. The operator was moving a pallet of 105mm illuminant candles from an operating building. While positioning the forklift to pick up the pallet, the operator allowed the mast to strike an overhead light fixture. Hot fragments from the bulb ignited the illuminants. The resultant fire spread quickly and caused approximately $900,000 damage prior to extinguishment.

2. Two employees were engaged in warehousing operations. A 55-gallon drum of cleaning solution blocked their access to the desired item. Using a forklift, one employee moved the drum so the second employee could reach the stock. After returning the drum to its original position, the forklift operator backed into a two-pallet stack of drums. The top drum fell and struck the assisting operator, severely lacerating his leg.

3. A forklift operator was attempting to place an 800-pound dockboard on a wooden pallet. The operator was backing the lift slowly in an effort to slide the tines from beneath the load. Suddenly the sliding ceased and the dockboard began to move. The operator raised the tines to position the dockplate

in order that simultaneous backing and lowering would drop the dockboard in place. With the dockboard at a tilted height of three feet, a co-worker tried to realign the pallet. This slight movement caused the dockboard to slip from the tines. The falling dockboard resulted in a fatality as the co-worker's head was crushed.

4. A forklift operator was engaged in his regularly assigned warehouse duties when it became necessary to move a stock item from the top of a material stack. Rather than lower the top pallet to floor level to obtain the desired item, the operator raised a standard wooden pallet to a height of approximately ten feet, climbed the forklift onto the pallet and attempted to remove a 90-pound item from the material stack. The employee lost his balance, fell to the floor and suffered a shoulder fracture.

5. An employee was assigned to housekeeping duties around an outside storage rack located near a welding shop. During the course of his work, he decided to move a forklift from his worksite to the building nearby. In making his approach, the worker failed to decelerate and rammed the forklift into the double doors of the building. Damage to the doors was approximately $275.00. Investigation revealed that the employee was not duly licensed to operate a forklift, or for that matter, any type of wheeled vehicle/equipment.

6. A warehouseman was required to check the yardage on a bale of cloth stored on top of a stack of material. He stepped onto a standard pallet while the tines were in the low position and ordered another employee to engage the lift lever. During his ascent he placed his right hand on top of the vertical package guard. The lift mechanism continued to the extent that the package guard struck an overhead beam, thereby amputating two fingers of the worker's right hand.

7. A forklift operator was assigned to load an outbound freight truck with racks of engines. Individual rack weight was 1,560 pounds. The operator, utilizing 4,000 pound capacity equipment, attempted to move three racks in one lift. The forklift tilting mechanism gave away due to overloading and the engine racks fell to the floor. Property damage to the dropped load totaled $2,000.00.

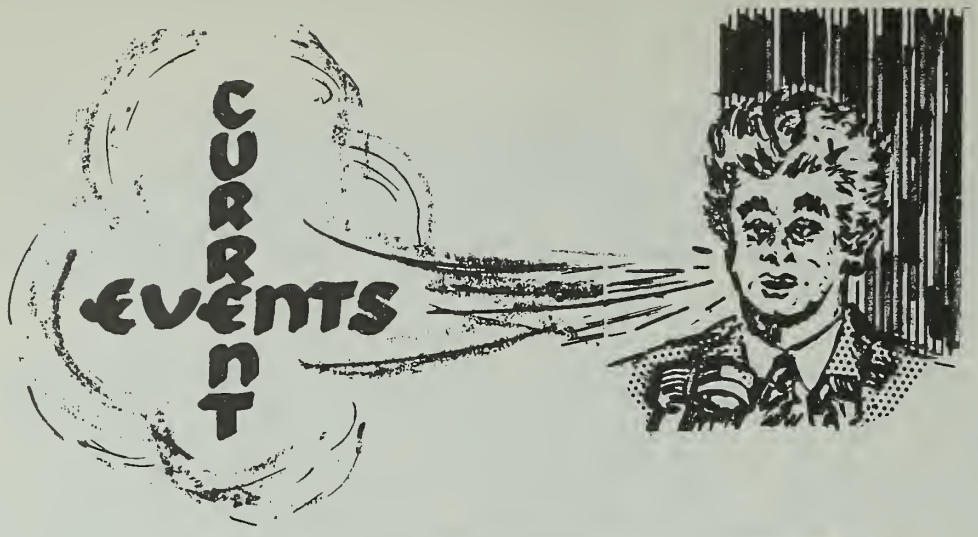
8. An employee was operating a forklift in a scrap metal storage yard. Departing from the worksite, the worker was beckoned by another employee who was seeking a ride to the restroom. Shortly after the latter had seated himself on the left rear fender, the operator ran over a piece of sheet metal in

an attempt to "scare" his passenger. As the metal was thrown upward by the front tire of the forklift, the rider tried to stop its movement with his left foot. His efforts caused him to slip from the fender, catching his left foot under the wheel of the moving forklift. Resultant injury was a fracture of the left foot.

9. Four workers were assigned to move a large precision grinder which had been delivered to a point just outside the machine shop. It was decided to remove the grinder from its skid, place it directly on the forks and transfer the load to a dolly located inside the building. The approach to the building was on a slight downward slope. In his attempt to negotiate the driveway, the operator moved only a few feet when the grinder toppled from the tines. Damages to the grinder were set at $3,000.00.

10. A maintenance employee had returned a forklift to the control of production personnel after having installed a seat back rest on the same. A production supervisor connected the battery plug as the assigned operator was mounting the forklift. In the act of mounting, the operator inadvertently depressed the accelerator, causing the forklift to move backward (lift had been parked with control lever in "reverse" and ignition switch in "on" position). The mechanic who had stepped behind the forklift to gather his tools was caught between the moving forklift and a parked unit. He suffered a pelvis fracture.

With statistics such as these and facts to support them, it would be easy to dismiss concern over such accidents as "the problem of the supervisor." This would be a nonsensical solution. Adherence to the criteria of Chapter 24, AMCR 385-100, with a solid training program for operators plus added depth to their ranks so supervision can always have trained lift operators will certainly be a step in the right direction. This alone will not be enough. Intermediate management must support first-line supervision so that time for training is allotted and qualified operators are supplied to the crews who need them.




## WORKERS SUFFER AMMONIA BURNS

An Ammonia Oxidation Plant (AOP) had been turned over to production personnel after having been shut down for condenser and column repairs for one week. Immediate attempts to restart the operation were unsuccessful, so the column was shut down for maintenance to the control system.

It was decided that the reflux line from the condenser should be inspected for possible plugging. Two maintenance employees opened the flange at the orifice. After a brief period of time, a solution of ammonia and water sprayed from the opening onto the employees. Two workers sustained lung irritation and eye burns while four others were treated for similar conditions of a lesser degree.

Poor planning was considered to have been the underlying cause of the accident. Had the employees utilized personal protective equipment, the incident might not have yielded injuries. To prevent the occurrence of similar accidents, the installation implemented the following actions:

1. Employees have been reinstructed that approved personal protective equipment must be worn during such repair work.

2. Lines to be broken for inspection and/or repair must be purged with water, vented and isolated from the system.

3. As a backup measure for subject repairs, an additional worker must be at the worksite manning a running water hose.

4. Only those employees necessary for the repairs at hand will be present at the worksite.

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## HE PUT HIS FOOT IN IT

A contractor employee had resumed his forklift duties after a lunch break and was preparing to move a pallet of boxes. Upon mounting the forklift, the operator, not being satisfied with the "feel" of the seat, placed his foot against the hoist mechanism to aid in moving the seat back. As he pushed the seat, his knee hit the control lever causing the hoist mechanism to actuate.

The sudden rise of the hoist mechanism grabbed the operator's right foot. The employee banged the control lever with his fist to lower the device thus freeing his foot. The injury was severe to the extent that amputation of four toes was necessary.

It was determined that the primary cause of the accident was the operator's intentional placement of his foot on the hoist mechanism. This act was in total disregard to safety instructions given the employee in prior training sessions. The installation implemented the following actions to prevent the occurrence of similar accidents:

1. Supervisors and forklift operators will be required to undergo refresher training which will stress safe forklift operating practices.

2. Metal guards are being fabricated and will be installed on forklifts to prevent operators from placing hands or feet into the hoist mechanisms.

3. All forklift operators were instructed to turn off the ignition and dismount the forklift when the equipment is not in use.

## °AEROSOL CAN EXPLODES

A contractor employee was engaged in a trash disposal operation. During the course of his duties, the worker stood on the bed of a stake and platform truck and off-loaded inert refuse into an adjacent burning pit.

As the employee threw scrap material into the smoldering pit, a minute explosion occurred from the heating of a previously discarded aerosol can. The worker suffered a nose fracture and facial lacerations when a fragment from the can struck his face. Fragment impact knocked out the right lens of the injured's safety glasses; however, the employee's usage of eye protection perhaps saved his eyesight.

It was determined that the employee was not cognizant of the hazard potential in working near burning operations capable of propelling missiles; i.e., heating of pressurized containers whose presence was unknown.

In an effort to prevent similar occurrences, the installation revised the applicable standing operating procedure to restrict off-loading trucks from the pit area during actual burning (or smoldering). Special emphasis is being placed on disposal of pressurized containers at a land fill operation. The details of this accident were disseminated plant-wide.

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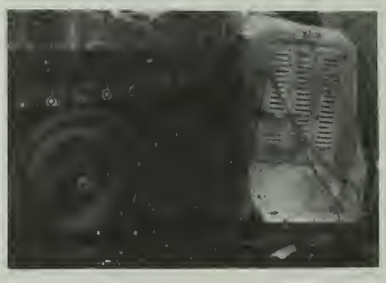
## VEHICLE STRIKES WELDING MACHINES

A civilian employee was moving an M110 combat vehicle from a parking apron adjacent to a building. The driver lost control of the vehicle and struck two portable gasoline-powered welding units that were located approximately ten feet from the building.

Position of M110 combat vehicle with respect to both welding units.



Point of impact of vehicle, welding unit and building.

One of the welding units was pushed through the sidewall of the building, and the resultant impact caused the welding unit's gasoline tank to explode. Although the flames enveloped the driver, he was able to disembark from the vehicle unassisted and help toward extinguishment of the blaze.

The employee suffered first, second and third degree burns of the face, back, shoulders and arms. Damage to the building and welding units totaled slightly over $3,700.00.

The driver failed to maintain control of his vehicle. His efforts were complicated by a mechanical shortcoming whereby the service brake pedal adjustment was improperly positioned on the shaft causing the pedal to extend beyond the normal operating level. This condition prevented the driver from depressing the brake pedal to the extent necessary for positive braking action.

In an effort to prevent the occurrence of similar accidents, the installation has established job breakdowns to indoctrinate drivers in safe driving techniques. Also, the need for quality assurance inspections of brakes at points of assembly has been reiterated.

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## MUNITIONS TRUCK OVERTURNS

A contractor employee was operating a 5-ton truck-tractor and trailer which contained 20 pallets of loaded 175mm projectiles during an intra-plant movement. The driver was a supervisor. As the driver negotiated a 90° left curve at an estimated 10-15 miles per hour, both the tractor and trailer overturned.

Overturned vehicle, front view.

Cargo, 175mm projectiles.

The tractor received damage to the door, mirror, fender, grille and front spring, all on the right side of the vehicle. Also, the trailer was damaged on its right side. As a result of packaging configuration, the cargo incurred no damage. Total damage costs to both tractor and trailer were estimated at $2,400.00. The driver was not injured.

It should be noted that approximately 18,000 pounds was being transported by a 5-ton tractor-trailer unit.

Investigation of the accident indicated that excessive speed was the primary cause of the accident. To preclude the occurrence of similar accidents, the installation has taken the following actions:

1. The use of supervisory personnel to perform hourly employee driver duties was prohibited. Although the driver involved in subject incident was trained and qualified, he had not recently driven this type vehicle.

2. Drivers have been instructed to come to a complete stop prior to negotiating 90° turns with a loaded trailer. To preclude shifting of cargo, this requirement is applicable to any trailer hauling any type of ammunition which is loaded on conveyors in the bed of a trailer.

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## SAFE DRIVING ACHIEVEMENT

To drive to and from work without experiencing an automobile accident over a short period of time is considered to be a normal happening for many people. But to safely drive a cumulative total of 582,000 miles to and from work over a period of 29 years is a most enviable feat.

Impossible? Not for Mr. Shumate L. Rickenbaker, a recently retired warehouse supervisor at Charleston Army Depot, who accomplished such a record driving to and from work from Round O, South Carolina, a one-way distance of 48 miles. Mr. Rickenbaker stated that he had purchased and operated 16 new cars during this period, had only three flat tires, ran out of gas only once and had witnessed many accidents en route but maintained his record by observing basic safe driving habits -- leaving for work early enough to be on time and insuring that his automobile was in top-notch mechanical condition.

Mr. Rickenbaker received an individual certificate of recognition from the Commanding General, US Army Materiel Command. Presentation of the award was made by LTC G. R. Hasty, Commanding Officer, Charleston Army Depot.

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## FATAL FALL FROM SPEEDING AMBULANCE

An AEC operating contractor employee was fatally injured when he fell from the right rear side door opening of an ambulance which was traveling at a speed of 70 to 75 miles per hour in response to an emergency request. The employee served as an aidman for the contractor and was in the rear of the ambulance preparing oxygen and suction equipment when the door was accidentally opened and he fell out.

The following facts were findings of the accident investigation board:

1. The rear doors of the ambulance were hinged at the rear of the vehicle.

2. The electrical safety interlocks for the doors were not functioning due to a loose wire.

3. The aidman fell out of the ambulance by either: (a) accidentally tripping the door handle and opening the door which caught the wind, leaving the doorway open, through which he fell; or (b) attempting to reclose the door after noting the door was not fully closed. The force of the air created by the forward motion of the vehicle may have caused the door to swing open and pulled the aidman from the vehicle.

4. If the electrical interlocks had been properly functioning, or if the ambulance had been ordered with front-hinged doors (available as an option), this accident would not have occurred.

The following steps were taken in response to recommendations made by the investigation board.

1. The checklist which is completed at the beginning of each shift by aidmen on duty was revised to include the functioning of doors and associated locks on the ambulances. Preventive maintenance inspections will include the interlocking systems from an electrical standpoint.

2. Ambulances with rear-hinged side doors were modified to hinge at the forward position.

3. Door striker plates were modified so that the interlocking system functions even when the doors are not completely closed.

4. Warning signals have been installed to advise the driver by a buzzing signal whenever any door is not completely closed.

5. Industrial safety personnel will review all future procurement requests for special category vehicles to ensure that maximum safety requirements are incorporated.

- Serious Accidents, Issue No. 314
US Atomic Energy Commission
Washington, D.C. 20545

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## NATIONAL BUREAU OF STANDARDS SURVEYS TIRE USAGE

The Bureau has made a thorough review of most of the available data on how automobile tires are used and maintained in this country. The major findings of this study, conducted by J. L. Harvey and F. C. Brenner of the NBS Office of Vehicle Systems Research, and sponsored by the Department of Transportation, are:

1. Severely worn tires probably are the cause of many accidents, as a greater percentage of such tires were found on vehicles involved in accidents than in the general tire population.

2. Vehicles in accidents have a larger number of severely worn tires on the rear than on the front, suggesting that it is safer to put newer or less worn tires on the rear.

3. The risk of tire disablement and loss of vehicle control rises sharply for tires with less than 2/32 in tread depth remaining.

4. More than 1 in 4 cars had at least one seriously underinflated tire--by 4 psi or more--and underinflation can lead to early tire failure.

5. About 2 percent of cars are overloaded by 10 percent or more, and about 6 percent of cars are somewhat overloaded. On the average, most cars are loaded to about 80 percent of their allowable load.

That tires are an important factor in automotive performance and safety is a fact universally accepted. What tends to be ignored is that how tires are used plays an important part in their safety and performance. Tires cannot--or should not--be installed and forgotten. Regular inspection, and attention to proper inflation, play an important part in determining how long and how well they perform.

-NBS Technical News Bulletin

# PROMOTE SAFETY WITH MENU BOARDS

Ralph L. Bent, Safety Department
Sperry Rand Corporation
Louisiana Army Ammunition Plant

At Louisiana Army Ammunition Plant, widespread use is made of changeable letter boards, commonly referred to as "menu boards." These promotional aids are highly versatile, easy to install and can be maintained with a minimum of effort. Boards such as these can be tailored to a small or large area since they are available in a variety of sizes.

For example, the board pictured right is four feet wide, six feet high and is installed behind the serving line in the main cafeteria in the administrative area. Messages are changed every two weeks in order to present information of a current and seasonal interest. A glass-enclosed menu board, two feet wide and three feet high is installed in the lobby to the main Administration Building. It displays messages of interest to vendors' representatives and other visitors to the Plant.


In addition, one 20" X 30" glass-enclosed menu board is installed behind the serving line in each production line cafeteria and on a safety display in the Allied Trades Building of the plant maintenance area. Information on these boards includes a short safety slogan and the name of the Chairman of each Employees' Safety Committee for each shift in the area concerned. Each month the Safety Representative assigned to the area removes the felt insert and brings it to the main Safety Office where new slogans and information are posted. This is accomplished in an expeditious manner so that the board will only remain empty for a short period of time.

Another board has been installed in the Conference Room where the new-hire orientation is conducted. This board welcomes the new employees to the Plant on behalf of the Safety Department and displays a friendly safety slogan. Still another board has been installed in the Industrial Training School and presents catchy safety slogans regarding safety training.

Many favorable comments have been received from our employees and visitors to the Plant regarding the professional appearance and eye-catching effectiveness of the menu boards. Cost of board maintenance is negligible when the results of delete use are considered. Menu boards have proved to be an effective aid in safety promotion at Louisiana Army Ammunition Plant.

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## REFERENCE PUBLICATIONS

| | |
|---|---|
| AR 190-5<br>29 Sep 70 | Military Police - Motor Vehicle Traffice Supervision |
| AR 385-80<br>16 Oct 70 | Safety - Nuclear Reactor Health and Safety Program |
| AMCR 70-52<br>7 Oct 70 | Research & Development - System Engineering |
| AMCR 385-30<br>8 Sep 70 | Safety - Particle Accelerators |
| AMCR 420-2<br>20 Oct 70 | Facilities Engineering - Motorized Fire Apparatus |
| AMCR 750-20<br>11 Sep 70 | Maintenance of Supplies and Equipment - Ammunition Peculiar Equipment (APE) |

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# SAFETY IN MECHANIZATION

J. R. Fore and J. L. Self, Propellant Department
Hercules Incorporated
Radford Army Ammunition Plant

Production processes are mechanized primarily to increase production and reduce cost per unit produced. However, as a process is improved for efficiency,it can be simultaneously improved for safety. The development and production programs for the assembly of the stick propellant charge for the M-62, 66mm Light Anti-Tank Weapon (LAW),are excellent illustrations of how safety can be applied to mechanical techniques. As the manual operations of charge assembly were replaced by machines, production costs and personnel exposure to fire hazards were reduced by more than 50 percent.

Experience by the Army dictated a need for an improved weapon for close-in offense and defense against targets ranging from personnel to the heaviest known tank. The weapon was to be mobile, light weight, self-contained, quite accurate, and had to provide greater fire power than available shoulder weapons or 3.5-inch rockets. Safety to the soldier during launching was imperative.

After its conception in early 1958, the LAW weapon and disposable launcher were developed as a joint effort by the assigned contractors and the Army. The manufacture of high-burning-rate M-7 propellant sticks, along with assembly of these sticks into propellant charges, was assigned to Hercules Incorporated at Radford Army Ammunition Plant.

Conventional mixing and extrusion methods are employed to manufacture the double-base propellant. The extruded solvent-wet strand is cut to 8-foot lengths. To reduce propellant loss

because of crooked sticks, approximately 50 of these strands are placed as straight as possible on a drying board. After drying, the strands are cut into sticks of a predetermined length on a modified cannon propellant cutter and sorted. These single-perforated propellant sticks are supplied to the finishing and charge assembly operations with a nominal stick length of 5.5-inches and approximate outside diameter of 0.25 inches. Each propellant stick must be reamed on one end, into which a flat head pin, with a head diameter slightly larger than the propellant stick outer diameter, is inserted. Nineteen of these pin-stick assemblies are dropped through the holes in a round suspension plate to complete the assembled propellant charge for one LAW round. The holes in the suspension plate are large enough to permit the propellant stick to drop through, but not the pin head. The suspension plates serve to suspend the propellant sticks in the motor case.

It was planned to mechanize the entire operation of propellant charge assembly from the beginning of the program. However, in order to supply an urgent need for finished charges, the assembly operations were initially done by hand while machines were being designed and fabricated.

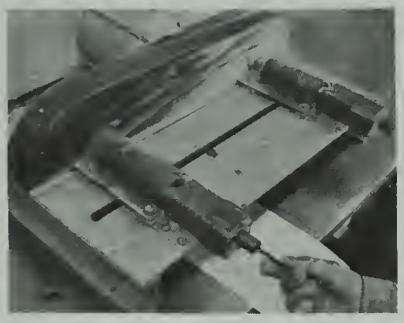
1

2

Originally (Photo 1), a propellant stick was held at 30° from the vertical under the pipette to catch one drop of the potting compound and the pin was inserted and tapped into the stick with a small mallet. However, the use of such a tool caused cracked and damaged sticks. Manual insertion with the three-finger method (Photo 2) was then adopted and used until mechanization was accomplished.

Since two of the three components of the potting compound were hypergolic, if mixed in the incorrect sequence, and the potting compound required refrigeration to extend its short life, the original compound was not conducive to mechanization. Because of these physical limitations and excessive personnel

exposure, a new potting compound and plastic jacketed pin were developed which facilitated mechanization and provided a superior pin-to-stick-bond. This required that each stick be reamed on one end to maintain a constant inside diameter.



3

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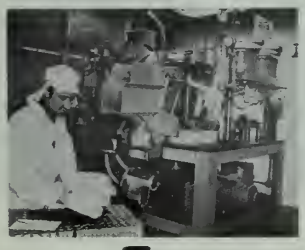
Photo 3 illustrates hand reaming. Mechanization of the reaming process was accomplished by an "A" machine (Photo 4). Personnel exposure to propellant was reduced by the "A" machine, since an operator no longer held the propellant stick during reaming and the number of people required for the reaming process was reduced. In order to eliminate hazardous propellant chips and dust accumulation, a vacuum system was installed which collected the chips and dust under water.



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A "B" machine (Photo 5) was designed which mechanically dips the plastic jacketed pin into a solvent bath and inserts it into the propellant sticks. This operation effectively reduced operator exposure and handling by better than two-thirds and increased production six fold.

Handling of propellant and excessive personnel exposure occurred during hand assembly of the propellant sticks into charges (Photo 6). The "C" machine which mechanized the charge assembly, increased production approximately four times and reduced personnel exposure accordingly (Photo 7).

A system of interlocks was installed on each of the "A," "B",and "C" machines. Solvent vapor buildup in the enclosed electrical system is prevented by a constant air purge. By means of an interlock, the machines shut down automatically, and will not start if the air purge fails. If a propellant stick jams, an interlock stops the machine to provent dangerous pinching and mutilation of propellant. When the air supply which aids in the propellant chip and dust collection, drops below a specified pressure, the "A" machine stops. Slip clutches are used on the machines between the motors and drive shafts. This prevents damage if for some reason a moving part malfunctions. Electric motor brakes are also employed to eliminate machine drift after power cutoff. Emergency stop buttons are installed at convenient locations on each machine. Conductive rubber parts, nonsparking materials, guards on moving gears, and conductive grounds are other safety features utilized on the machines. All machines and personnel are well protected by deluge sprinkler systems.

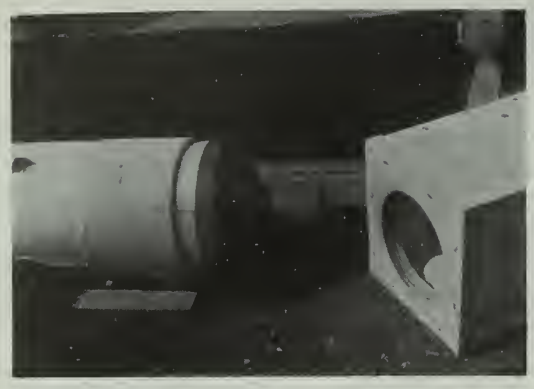
To summarize the safety achieved by mechanization, personnel exposure to propellant during charge assembly ("A," "B," and "C" machines) was reduced by 67 percent. For the overall operation (stick cutting to packout), exposure was reduced over 50 percent. More than four million propellant charges have been assembled without incident since mechanization was finalized. Production schedules far in excess of those considered practical when limited by manual capability have been achieved with improved operator safety and at sizable cost savings to the Army.

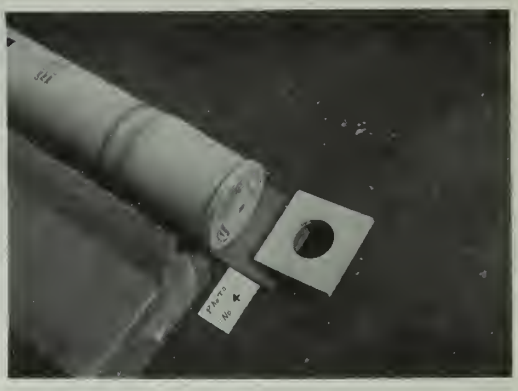
## THE ROLE OF MUNITIONS TESTING

Throughout the life cycle of Army materiel, items are subjected to many various tests as directed by the coordinated test program. Interwoven among several essential activities from early development through production and field use, testing is conducted to provide materiel assurance to several disciplines including safety. The following account should give insight into the "why" of testing from any of many viewpoints.

Vibration testing of 152mm Slug Model 10 ammunition was being conducted in a vibration test facility. The building consisted of two rooms separated by a 12-inch fire wall. One room housed the vibration fixture, cooling and heating equipment, closed-circuit television (CCTV), and various transducers, while the second room contained supporting machinery and equipment. The control building was located remotely from the vibration facility. The purpose of vibration testing is to assure the munitions can withstand simulated transportation movements.

Six 152mm cartridges had undergone temperature conditioning (145°F.) and had been vibrated for 3 1/2 hours without incident in a horizontal configuration. The rounds remain in their respective containers for vibration tests in a vertical position. The container and its component breakdown are shown in Photos 1 and 2. As subject ammunition was being vibrated in a vertical position, a flash was noted on the CCTV in the control building. A number of separate and distinct deflagrations were observed. Fire, from the munitions, spread throughout the building. Property damage to the building and its contents was approximately $60,000.00.





The probable cause of the fire was damage to or heating of a cartridge within the container. Photo 3 shows a round after vibration. Note the wear mark on the slug as a result of motion with the wooden block. Photo 4 shows evidence of slug motion on the fiber spacer. An intensive investigation is continuing to assure that the tests were properly conducted and that no external factor generated the fire.

## SEAT BELTS SAVE LIVES

Over the past several years, the National Safety Council has urged drivers and other auto occupants to "buckle up for safety"; that is, to wear seat belts whenever traveling in a car.

The Council estimates that if all those car occupants involved in traffic accidents last year were wearing their seat belts, 8,000 to 10,000 lives could have been saved. The Council also estimates that from 2,700 to 3,300 lives were saved during 1969 because auto occupants who were involved in traffic crashes were wearing their seat belts.

How does the Council arrive at this conclusion? The figures are projections representing the professional judgment of the Council's traffic and statistics departments and are based on a number of industry figures and related factors.

In discussing the extent of seat belt usage, it is necessary to take into account the following items:

1. The number of vehicles equipped with seat belts;

2. The number of persons who use seat belts;

3. The number of persons using seat belts at a given time, the "net usage" figure.

The number of cars equipped with seat belts is fairly accurately known. However, determining the number of persons who use the belts, when they use them, and for what portion of traveling time they use them are factors that are difficult to measure accurately.

Who uses seat belts? Studies have shown that older drivers use seat belts more than young drivers; male drivers more than female drivers; they are used more when traveling on superhighways than on city streets.

Other studies show that people who need seat belts most generally use them the least. Driver groups with higher accident involvement rates tend to use seat belts less than driver groups with lower rates. Therefore, any study of seat belt usage among persons involved in traffic accidents will not properly represent the usage for the general public. That is, it will probably underestimate the overall extent of seat belt usage.

The only widely-diversified group of drivers to provide annual seat belt usage figures during the 1960s were those who volunteered to have their vehicles safety checked. Because of their obvious concern for car safety, this group's positive responses to questions on seat belt usage could be expected to be higher than that of the driving population as a whole.

Again, because of the number of variables involved, absolutely accurate estimates on the extent of seat belt usage cannot be made. However, within the stated limits, the National Safety Council has determined that:

1. During 1969 seat belts were available to about four out of five passenger car occupants in the United States;

2. Seat belts were used only about 40 percent of the time, on the average; and

3. Consequently, only about one out of every three car occupants is using his seat belt at any given time.

These conclusions can be considered indications of the life-saving capability -- both realized and potential -- that can come about from the use of seat belts by auto occupants.

The National Safety Council urges that the next time you hear or read the phrase, "Buckle Up for Safety," remember that last year from 2,700 to 3,300 Americans **owe** their lives to their seat belts.

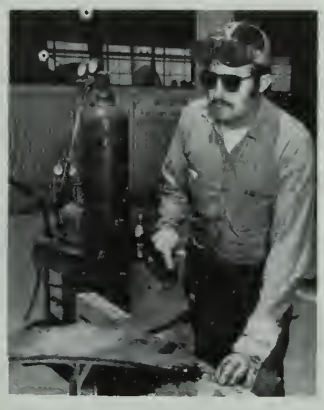
- Public Information Department
National Safety Council

## WISE OWL CLUB HAS NEW MEMBERS

Recent incidents at Sharpe Army Depot have gained membership for Messrs. Oleon Burchfield and Donald Quinton to the Wise Owl Club. Workers who escape serious eye injuries through the wearing of safety glasses are qualified to join this exclusive organization.

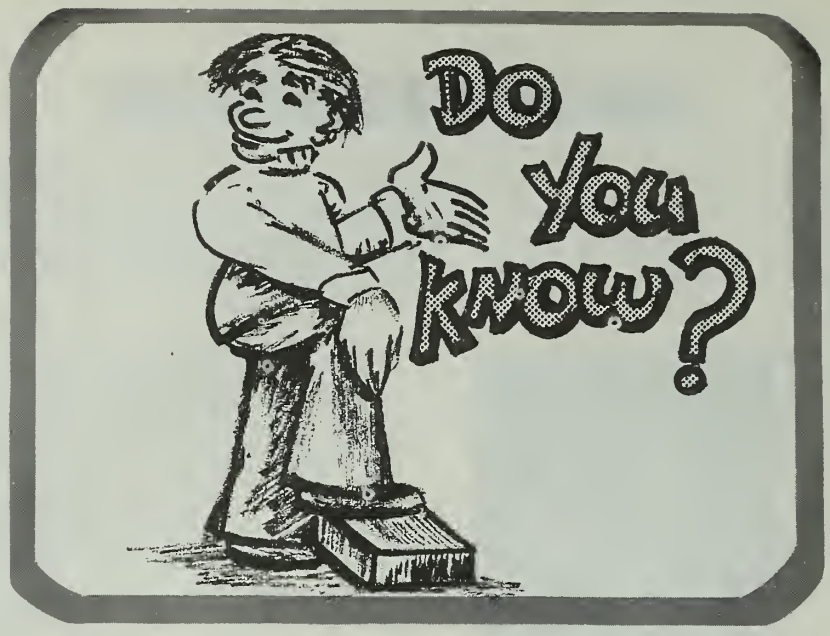

Burchfield, an electrician, was repairing a control panel when a bolt slipped and struck an energized circuit. The resultant flash spewed hot metallic particles onto his glasses. Photo 1 shows the immediate worksite and the lens damage caused by the metal flyings.

Quinton, a welder was fabricating an engine mounting bracket at the time of the accident. Having completed his cutting operation, he removed his safety goggles, but continued to wear his safety glasses. While chipping the hot slug, a large piece struck his glasses. The operation being performed and the resultant right lens damage is shown in Photo 2.



The wearing of safety glasses prevented serious injury and possible blindness to both men. As an afterthought to their good fortune, Messrs. Burchfield and Quinton have spoken to fellow employees in regard to the importance of eye protection utilization when performing potentially hazardous tasks.

- Information Office
Sharpe Army Depot




Here are ten questions that will test your knowledge of safety requirements that you will need under different circumstances. The answers to all of them may be found in AMCR 385-100. How many can you answer without referring to the regulation?

1. What should be incorporated in the design and construction of passageways between explosives buildings in order to prevent "funneling" of explosive forces?

Answer and reference:

2. May loaded ammunition items be electrostatically paint sprayed or deteared?

Answer and reference:

3. What publication gives the mandatory provisions for spray painting operations?

Answer and reference:

4. May carbon tetrachloride be stored in general warehouses?

Answer and reference:

5. How much water must be available for fire-fighting purposes in load line and explosives manufacturing areas?

Answer and reference:

6. May electric tools be used for machining operations on high explosives?

Answer and reference:

7. What general safety precautions are necessary in construction of magazines?

Answer and reference:

8. What guidelines should be followed for telephone locations in ammunition and explosives magazines storage areas?

Answer and reference:

9. What method should be utilized in the destruction of parachute flares?

Answer and reference:

10. What safety considerations should be given to water heaters?

Answer and reference:

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## MERDC WINS NSC AWARD OF HONOR

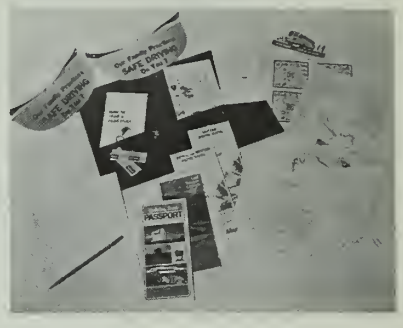
The US Army Mobility Equipment Research and Development Center has been informed that it will receive the National Safety Council Award of Honor for operating 3,004,950 man-hours from 12 June 1969 to 30 June 1970 without a disabling injury.

## VACATION SAFETY PROMOTION

In Spring of 1970, Hercules Incorporated, operating contractor at the Radford Army Ammunition Plant, initiated a new segment of its Off-The-Job Safety Promotion.

All employees were invited to request Vacation Safety Packets for their summer and fall travel excursions. The service was provided free by the RAAP Safety Department. Before the summer was over, some 400 families availed themselves of the opportunity.

The Vacation Packet provided pre-marked route maps to and from the employee's destination, log books for mileage, gas and lodging costs, travel tips, motel books, a first-aid chart and mouth-to-mouth resuscitation chart, and a 9-page summary of vacation safety exposures.



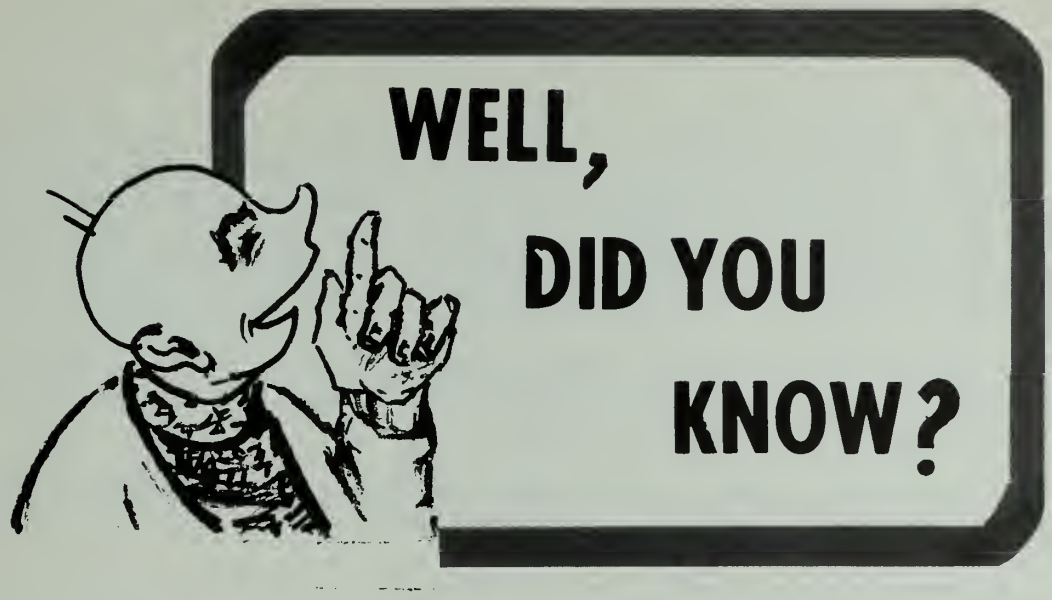

Vacation packet contains many helpful items.

In addition, the pocketed blue folder contained games and time-occupiers for the children, sun visors with safe driving message imprinted, a safety-green pencil, dashboard decals, and some band-aids.

The entire packet was personalized on the front cover by the Safety Superintendent.

To date, the direct cost has averaged less than 30¢ per packet, partly due to the participation of the major oil companies and insurance companies who freely contributed such items as the maps, log books, brochures and booklets as part of their advertising programs.

-Safety Office
Radford Army Ammunition Plant




■ Here are the answers to the questions on pages 32 and 33. All questions are based on information contained in AMCR 385-100. A reference to the pertinent paragraph follows each answer.

1. The funneling effect is reduced by implementing weak sections, openings and abrupt changes in direction of the passageways. Reference paragraph 5-14, AMCR 385-100.

2. No. Loaded ammunition items shall not be electrostatically paint sprayed or deteared. Reference paragraph 12-12b, AMCR 385-100.

3. Mandatory provisions of NFPA Standard No. 33, Spray Finishing, shall be followed. Reference paragraph 12-13a, AMCR 385-100.

4. Yes. Carbon tetrachloride may be stored in general warehouses in airtight drums. Reference paragraph 13-27a, AMCR 385-100.

5. At least 1,000,000 galons of water shall be stored or available for fire fighting in load line and in explosives manufacturing areas. Reference paragraph 12-28a, AMCR 385-100.

6. Yes. Electric tools may be used if the motors, switches, and wiring are of types suitable for the specific hazardous exposure being produced. Reference paragraph 26-15g, AMCR 385-100.

7. The following safety precautions are necessary in the construction of magazines:

a. Wood floors shall not be used.

b. Construction which might allow accumulation of explosive dust must be avoided.

c. All doors and door frames to aboveground magazines must be made of or covered with fire-resistive materials having some insulating value, such as rigid asbestos composition sheet, to fit as tightly as possible to seal the opening. Exteriors of magazines should be kept completely covered with fire-resistive materials, having some insulating value and being easily friable.

d. Magazines usually are not wired for electric lights, but when electricity is used, installation shall conform to requirements of Chapter 6, AMCR 385-100.

e. Openings other than doors should be screened to prevent entry of insects, rodents and reptiles.

Reference paragraphs 18-4a through e, AMCR 385-100.

8. The following may be used as a guide for telephone locations in ammunition and explosives magazine storage areas:

a. One per magazine block.

b. One per mile and readily accessible from installation roadway and railway systems, especially loading docks.

c. One per operating building (other than storage magazines) within the magazine area.

d. One per manned gate entrance or exit.

9. Parachute flares with pressed charges may be burned. A 4-foot spacing upon a layer of combustible material is recommended. Reference paragraph 27-24, AMCR 385-100.

10. Any water heater should be regarded as a boiler and should be equipped with safety valves of the temperature pressure type in accordance with the ASME Code for Boilers and Unfired Pressure Vessels.

Reference paragraph 9-31a, AMCR 385-100.

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LIFT RIGHT-
DAY'S BRIGHT

WRONG WAY-
SORRY DAY




# UNITED STATES ARMY MATERIEL COMMAND
# WASHINGTON, D.C. 20315